

# OC-3 CWDM OPTICAL SUPERVISORY CHANNEL SFP TRANSCEIVER

TRPE03KE2C000x0G CWDM



## Product Description

The TRPE03KE2C000x0G SFP fiber optic transceivers with integrated digital diagnostics monitoring functionality provide a quick and reliable interface for optical supervisory channel applications. The diagnostic functions, alarm and warning features as described in the Multi-Source Agreement (MSA) document, SFF-8472 (Rev. 9.4), are provided via an I<sup>2</sup>C serial interface.

The TRPE03KE2C000x0G transceivers use a CWDM DFB laser and an APD receiver to provide an optical link power budget of 44dB. The transceiver satisfies Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.

The transceivers connect to a standard 20-pad connector for hot plug capability. This allows the system designer to make configuration changes or maintenance by simply plugging in different types of transceivers without removing the power supply from the host system.

The transceivers have colored bail-type latch, which offers an easy and convenient way to release the module. The latch is compliant with the SFP MSA.

The transmitter and receiver DATA interfaces are AC coupled internally. LV-TTL Transmitter Disable control input and Loss of Signal output interfaces are also provided.

The transceivers operate from a single +3.3V power supply over an operating case temperature range of -5°C to +70°C (COM). The housing is made of metal for EMI immunity.



## Features

- CWDM DFB Transmitter and APD Receiver
- Lead Free Design & RoHS 6 Compliant
- 44 dB link budget
- Compatible with SFP MSA
- Designed for SONET OC-3 (156Mb/s) OSC Applications
- Digital Diagnostics through Serial Interface
- External Calibration for Digital Diagnostics
- Eye Safe (Class I Laser Safety)
- Duplex LC Optical Interface
- Excellent EMIT & ESD Protection

## Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature Range	$T_{ST}$	- 40	+ 85	°C
Operating Temperature Range <sup>1</sup>	$T_{OP}$	- 5	+ 70	°C
Supply Voltage	$V_{CC}$	0	+ 5.0	V
Maximum Input Optical Power <sup>2</sup>	$P_{in,max}$	-	+ 3.0	dBm
Input Voltage	$V_{IN}$	0	$V_{CC}$	V

<sup>1</sup> Measured on top side of SFP module at the front center vent hole of the cage.

<sup>2</sup> In order to protect APD ROSA, high input optical power Endure time <30S

### Transmitter Performance Characteristics

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate <sup>1</sup>		$B$	-	156	-	Mb/s
Average Optical Output Power (coupled into single mode fiber), 50% duty cycle		$P_o$	+ 1.0	-	+ 5.0	dBm
Extinction Ratio		$P_{hi} / P_{lo}$	10	-	-	dB
Center Wavelength	1471	$\lambda_c$	1464.5	1471	1477.5	nm
	1491		1484.5	1491	1497.5	
	1511		1504.5	1511	1517.5	
	1531		1524.5	1531	1537.5	
	1551		1544.5	1551	1557.5	
	1571		1564.5	1571	1577.5	
	1591		1584.5	1591	1597.5	
	1611		1604.5	1611	1617.5	
Spectral Width (-20dB)		$\Delta\lambda_{20}$	-	-	1.0	nm
Side Mode Suppression Ratio		$SMSR$	30	-	-	dB
Transmitter Output Eye		Compliant with Telcordia GR-253-CORE and ITU-T Recommendation G.957				

<sup>1</sup> Data rate ranges from 50Mb/s to 266Mb/s. However, some degradation may be incurred in overall performance.

### Receiver Performance Characteristics

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate <sup>1</sup>		$B$	-	156	-	Mb/s
Receiver Sensitivity ( $10^{-10}$ BER) <sup>2</sup>		$P_{min}$	- 43.0	-	-	dBm
Maximum Input Optical Power ( $10^{-12}$ BER) <sup>2</sup>		$P_{max}$	- 7.0	-	-	dBm
LOS Thresholds	Increasing Light Input	$P_{los+}$	-	-	- 43.0	dBm
	Decreasing Light Input	$P_{los-}$	- 52.0	-	-	
LOS Timing Delay	Increasing Light Input	$t_{loss\_off}$	-	-	100	$\mu$ s
	Decreasing Light Input	$t_{loss\_on}$	2.3	-	100	
LOS Hysteresis		-	0.5	-	-	dB
Wavelength of Operation		$\lambda$	1100	-	1600	nm
Receiver Reflectance		-	-	-	- 25.0	dB

<sup>1</sup> Data rate ranges from 50Mb/s to 266Mb/s. However, some degradation may be incurred in overall performance.

<sup>2</sup> Measured with 2<sup>23</sup>-1 PRBS at 156Mb/s.

### Laser Safety

**Laser Safety:** All transceivers are Class I Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.

**Oplink Communications, Inc.**  
DATE OF MANUFACTURE:




This product complies with  
21 CFR 1040.10 and 1040.11  
**Meets Class I Laser Safety Requirements**

**Transmitter Performance Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (TD+ & TD-) <sup>1</sup>	$V_{PP-DIF}$	0.25	-	2.4	V
Input HIGH Voltage (TX Disable) <sup>2</sup>	$V_{IH}$	2.0	-	$V_{CC}$	V
Input LOW Voltage (TX Disable) <sup>2</sup>	$V_{IL}$	0	-	0.8	V
Output HIGH Voltage (TX Fault) <sup>3</sup>	$V_{OH}$	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (TX Fault) <sup>3</sup>	$V_{OL}$	0	-	0.8	V

<sup>1</sup> Differential peak-to-peak voltage.

<sup>2</sup> There is an internal 4.7 to 10kΩ pull-up resistor to VccT.

<sup>3</sup> Open collector compatible, 4.7 to 10kΩ pull-up resistor to Vcc (Host Supply Voltage).

**Receiver Electrical Interface**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Differential Output Voltage Swing (RD+ & RD-) <sup>1</sup>	$V_{PP-DIF}$	0.6	-	2.0	V
Output HIGH Voltage (LOS) <sup>2</sup>	$V_{OH}$	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (LOS) <sup>2</sup>	$V_{OL}$	0	-	0.5	V

<sup>1</sup> Differential peak-to-peak voltage across external 100Ω load.

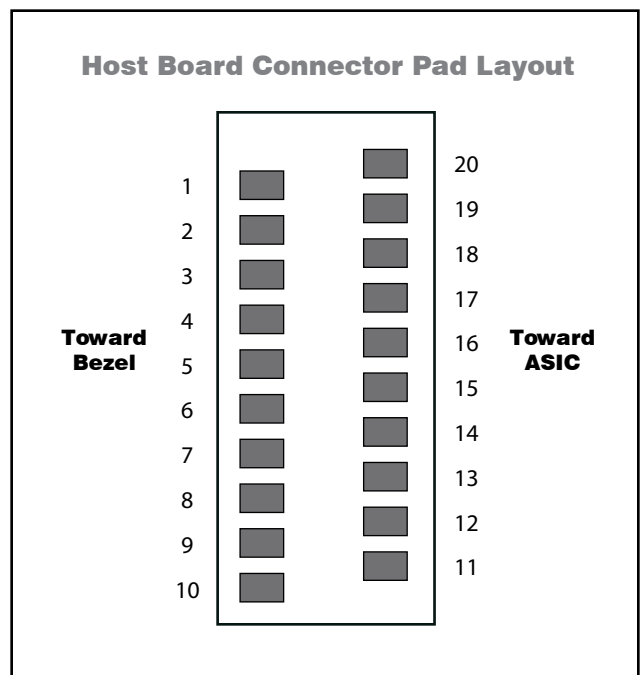
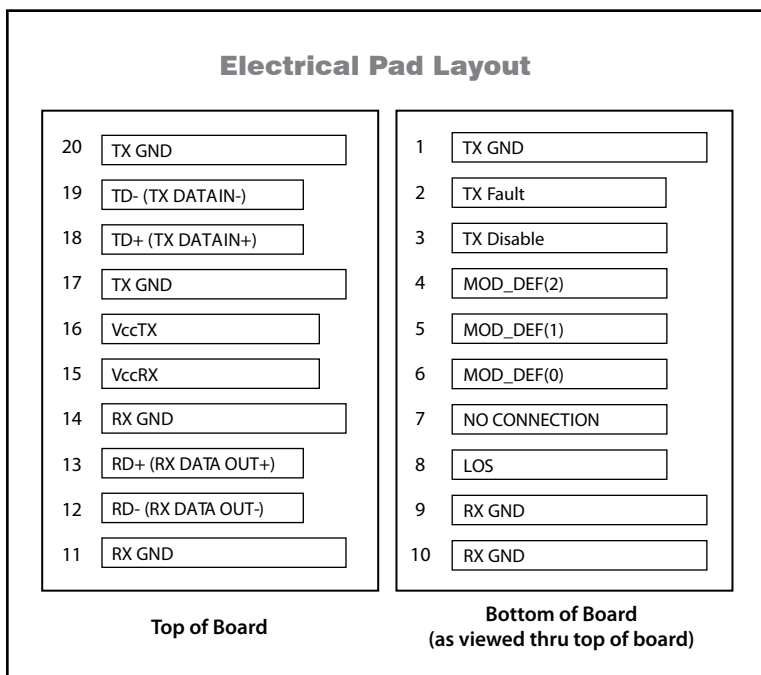
<sup>2</sup> Open collector compatible, 4.7 to 10kΩ pull-up resistor to Vcc (Host Supply Voltage).

**Electrical Power Supply Characteristics**

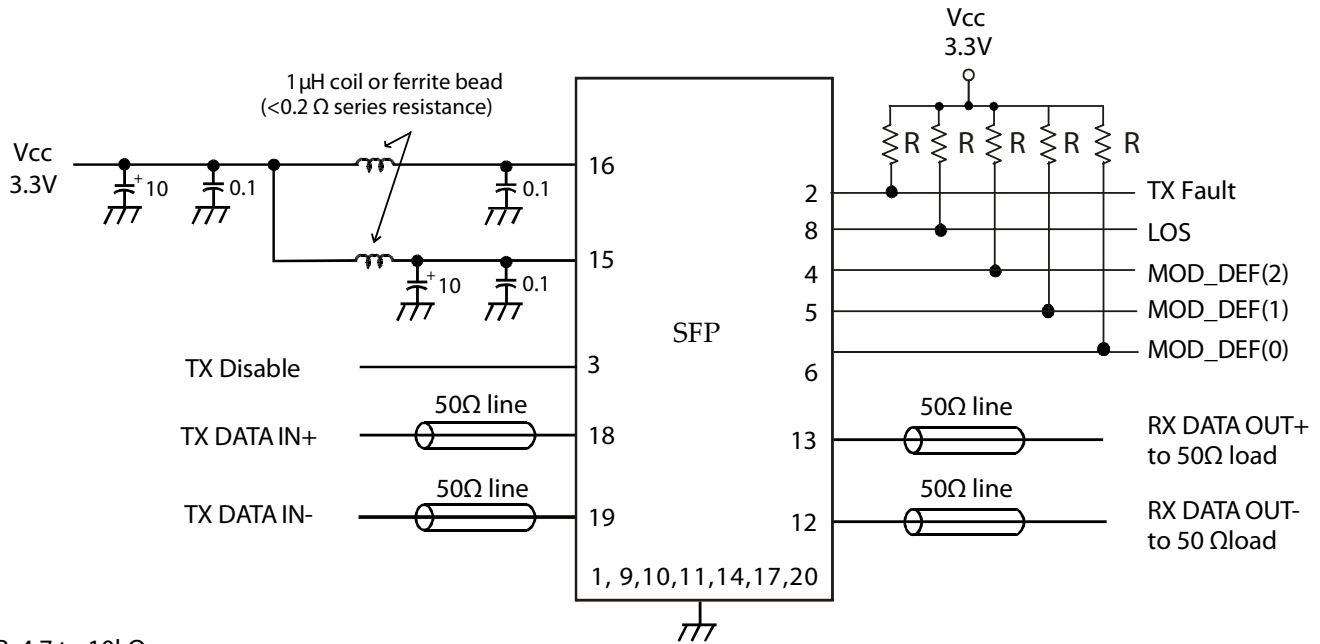
Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	$V_{CC}$	3.13	3.30	3.47	V
Supply Current	$I_{CC}$	-	210	310	mA

**Module Definition**

MOD_DEF(0) pin 6	MOD_DEF(1) pin 5	MOD_DEF(2) pin 4	Interpretation by Host
TTL LOW	SCL	SDA	Serial module definition protocol



**Application Schematic**



R: 4.7 to 10kΩ  
CAP Values in µF

**Application Notes**

**Electrical interface:** All signal interfaces are compliant with the SFP MSA specification. The high speed DATA interface is differential AC-coupled internally with 1µF and can be directly connected to a 3.3V SERDES IC. All low speed control and sense output signals are open collector TTL compatible and should be pulled up with a 4.7 - 10kΩ resistor on the host board

**Loss of Signal (LOS):** The Loss of Signal circuit monitors the level of the incoming optical signal and generates a logic HIGH when an insufficient photocurrent is produced.

**TX\_Fault:** The output indicates LOW when the transmitter is operating normally, and HIGH with a laser fault including laser end-of-life. TX Fault is an open collector/drain output that should be pulled up with a 4.7 - 10kΩ resistor on the host board. TX Fault is latched per SFP MSA.

**TX\_Disable:** When the TX Disable pin is at logic HIGH, the transmitter optical output is disabled (less than -45dBm).

**Serial Identification and Monitoring:** The module definition of SFP is indicated by the three module definition pins, MOD\_DEF(0), MOD\_DEF(1) and MOD\_DEF(2).

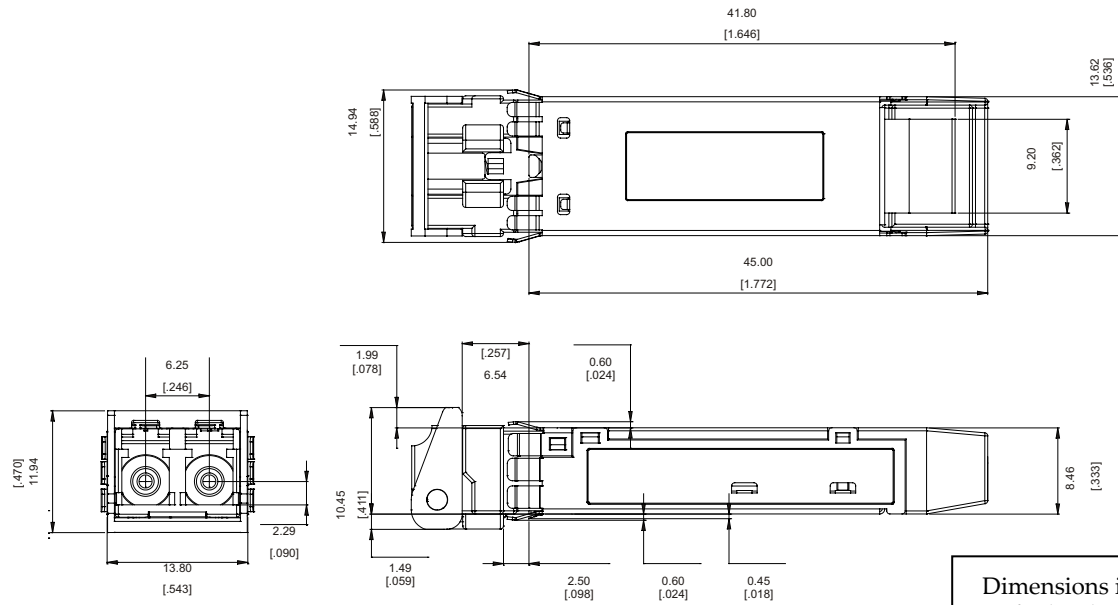
Upon power up, MOD\_DEF(1:2) appear as NC (no connection), and MOD\_DEF(0) is TTL LOW. When the host system detects this

condition, it activates the serial protocol (standard two-wire I<sup>2</sup>C serial interface) and generates the serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the SFP that are not write protected, and the negative edge clocks data from the SFP.

The serial data signal (SDA) is for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The supported monitoring functions are internal temperature, supply voltage, bias current, transmitter power, average receiver signal, all alarms and warnings and software monitoring of TX Fault/LOS. The device is internally calibrated.

The data transfer protocol and the details of the mandatory and vendor specific data structures are defined in the SFPMSA, and SFF-8472, Rev. 9.4

**Power supply and grounding:** The power supply line should be well-filtered. All 0.1µF power supply bypass capacitors should be as close to the transceiver module as possible.

**Mechanical Package**

**Ordering Information**

Model Name	Operating Temperature		Normal Wavelength (nm)	Link Budget	Latch Color
TRPE03KE2C00010G	- 5 °C to + 70 °C	Commercial	1471	44dB	Gray
TRPE03KE2C00020G	- 5 °C to + 70 °C	Commercial	1491	44dB	Violet
TRPE03KE2C00030G	- 5 °C to + 70 °C	Commercial	1511	44dB	Blue
TRPE03KE2C00040G	- 5 °C to + 70 °C	Commercial	1531	44dB	Green
TRPE03KE2C00050G	- 5 °C to + 70 °C	Commercial	1551	44dB	Yellow
TRPE03KE2C00060G	- 5 °C to + 70 °C	Commercial	1571	44dB	Orange
TRPE03KE2C00070G	- 5 °C to + 70 °C	Commercial	1591	44dB	Red
TRPE03KE2C00080G	- 5 °C to + 70 °C	Commercial	1611	44dB	Brown

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